

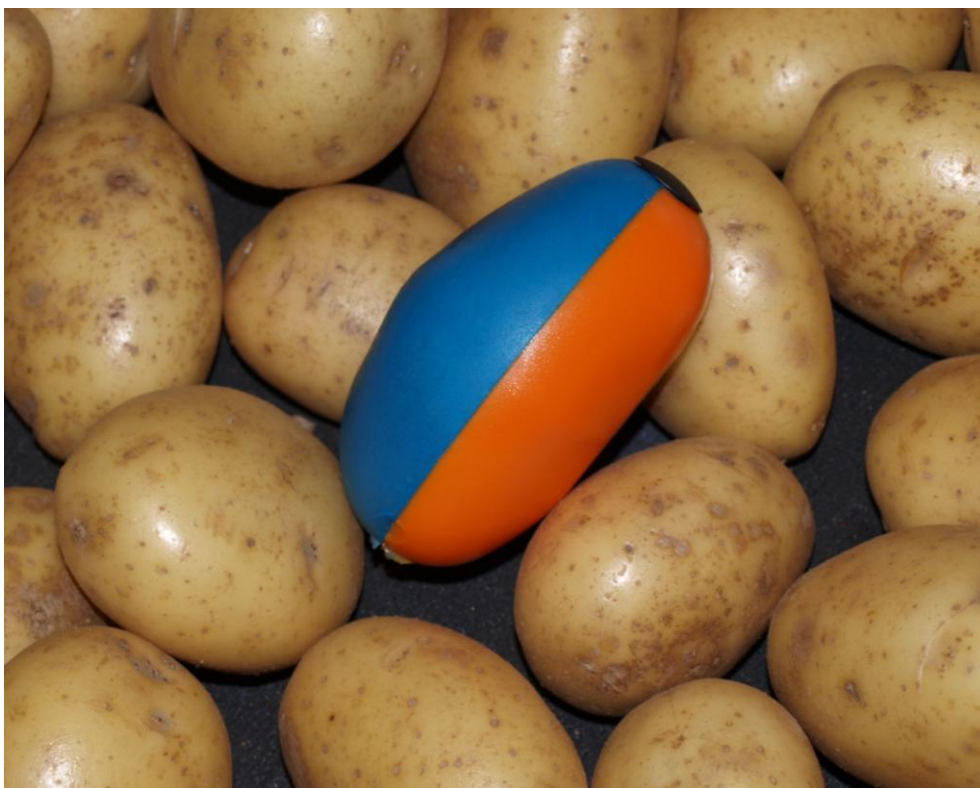
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# ***TuberLog***

PTR300

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## **INSTRUCTION MANUAL and USER GUIDE**



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Version 1.1

Distributed worldwide by

**Martin Lishman**

Tel: +44 (0)1778 426600 Fax: +44 (0)1778 426555

[www.martinlishman.com](http://www.martinlishman.com)

Manufactured by  
ESYS GmbH  
[www.esys.de](http://www.esys.de)





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# TuberLog

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## Quick Start Guide

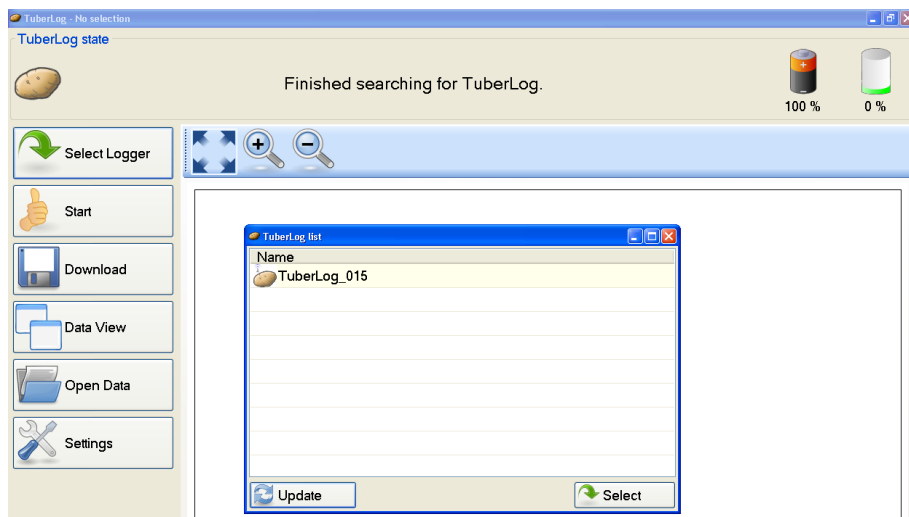
### 1. Ensure the *TuberLog* software is installed and Bluetooth is enabled in Settings

### 2. Connect *TuberLog* to the computer

- via the USB cable or
- start Bluetooth communication by shaking the data logger

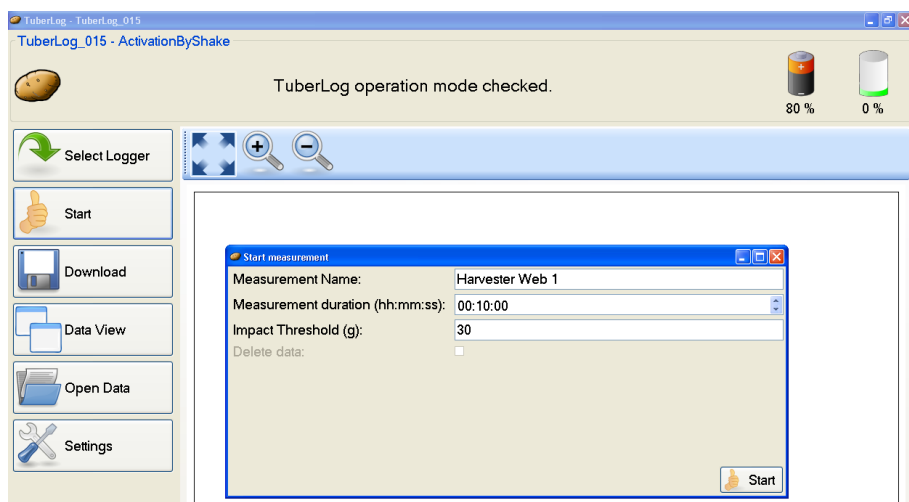
### 3. Select the data logger

Click **Select Logger** in the left menu bar to display the *TuberLog List* window; left click to highlight the data logger; left click **Select** in the bottom right of the window. The data logger should now be connected.



### 4. Start the data logger

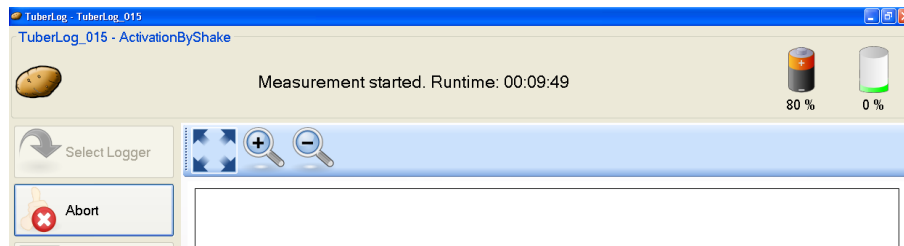
Click **Start** in the left menu bar to display the *Start Measurement* window; enter *Measurement Name*, *Measurement duration* and *Impact Threshold* as required; left click **Start** in the bottom right of the window.





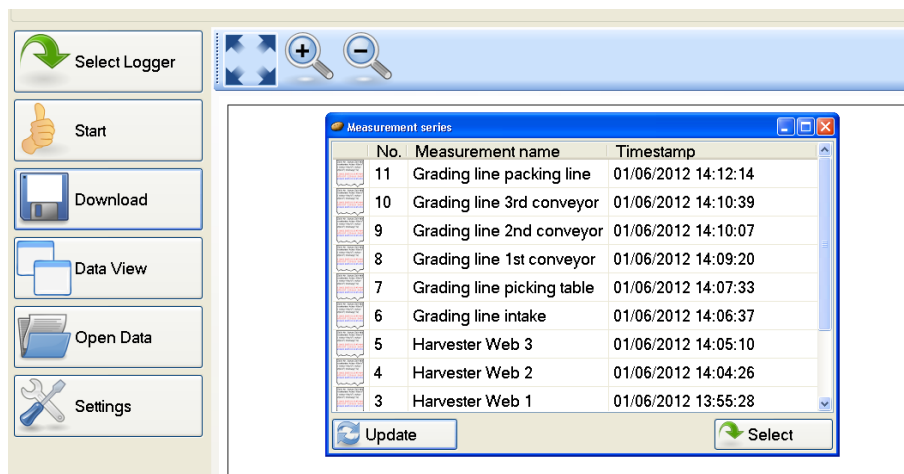
## 5. Place the data logger in the machine to be tested

The remaining measurement duration will count down at the top of the screen.



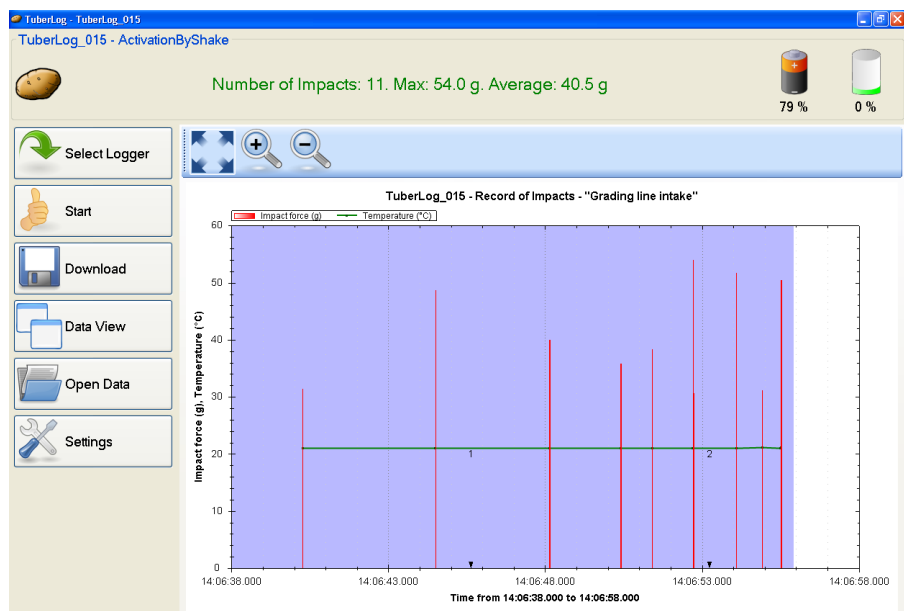
## 6. Display TuberLog data

If the measurement timer is still running, click **Abort** in the left menu bar (see above). Click **Download** to display the list of measurement names; left click to highlight the required measurement; left click **Select** in the bottom right of the window. The data will be displayed.



## 7. Change the data view

Click **Data View** to change the display mode from tabular to graphical view or percentage distribution.





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## 1. Introduction to *TuberLog*

*TuberLog* is a powerful quality control tool which assists in the drive towards high quality bruise-free potato production. It identifies damage and bruise-causing areas in all types of potato handling machinery from the harvester to the packing line.

*TuberLog* is an acceleration measurement device which records impact forces received while moving with real potatoes during harvesting and processing and locates damage and bruise-causing parts of machinery (including washers). It comprises a data logger embedded in a synthetic shape designed to mimic the size, shape and density of a ware potato.

The *TuberLog* data logger records impacts and temperature values during each measurement. The data can be stored in the logger itself or transferred by USB connection or Bluetooth to a PC or laptop where it can be stored and analysed using the software supplied.

*TuberLog* is powered by a rechargeable battery which is charged by connecting to the USB interface of a computer or with the USB charging kit supplied.

*TuberLog* should be used regularly so that bruising problems caused by poor machine maintenance or incorrect settings can be detected quickly. Machine settings are often changed, but the effects on bruising may not be realised. A quick check with *TuberLog* can make sure. Different varieties or the same variety at different temperatures can bruise at different impact levels. In conjunction with bruise testing *TuberLog* can help to ensure bruise-free working and provide peace of mind that quality standards are being maintained.

*TuberLog* will not indicate bruise levels in real potatoes and may not always discover all the sources of damage and bruising in potato handling machinery. But with experience the user can interpret information given by *TuberLog* which will go a long way towards eliminating quality problems in potato production.



## 2. Initial set-up of **TuberLog**

### 2.1 Equipment supplied

- Potato shape data logger including two sealing caps
- USB Memory Stick containing this manual and the data logger software
- USB connection and charging cable
- Bluetooth USB adapter
- USB charging kit (220V connector with alternative plugs, car adapter)

### 2.2 Install the software before connecting the data logger

Insert the USB Memory Stick into a USB port on the PC or laptop. A window should automatically appear on the screen with several options. Click on **Open folder to view files using Windows Explorer**. Click on the file **setup.exe** and follow the installation instructions displayed for the software and the USB driver installation. After installation of the software, you may find it useful to create a shortcut on the PC desktop. Drag the **TuberLog** potato symbol directly onto your desktop from the program list attached to the Start menu of your PC or laptop.

### 2.3 Communication between the data logger and the computer

The data logger can communicate with the PC to start measurements and download data via a USB interface, using the connection cable supplied, or via a Bluetooth connection, using either the built-in Bluetooth interface (present in most modern PC, laptop or notebook computers) or the Bluetooth USB adapter supplied.

Connect the data logger to the PC using the USB cable. The first time the connection is made the USB driver supplied will be installed automatically.

If Bluetooth functionality is already present this will be switched on automatically when the data logger is connected using the USB cable. For existing or internal Bluetooth adapters, the installed driver software must be able to support *Microsoft Bluetooth Stack*. If the Bluetooth adapter is required it should be installed in a USB port. It will be installed automatically with the Windows embedded drivers. The Bluetooth icon should appear in the task tray. Right click on the icon and select **Add device**. A list of available Bluetooth-enabled devices will appear. Select **TuberLog** and enter the pairing code (default: 1234) so that the data logger is recognised.

### 2.4 Charging the data logger battery

The data logger operates using an inbuilt rechargeable battery which can be charged via the USB interface of a computer using the connection cable or with the charging kit supplied. Data that has been saved in the data logger is not lost when the battery is empty but care should be taken that the battery has adequate charge for measurement and data download. The charge level is indicated on the screen whenever the data logger is selected for use (see 3.1).

Battery life is determined by how the data logger is started. After fully charging the battery it will last for about one month if the *Vibration Sensor Mode* in *Bluetooth Settings* (see 3.2) is set to *Activation by Shake* or *Always Off*. If the mode is set to *Always On* the battery will last for about 4 days without use or about 10 hours if *TuberLog* is used continuously.

### 2.5 Software settings

The operating and download settings of the data logger are set by the user. If repeated measurements are being made on the same machinery with the same potato variety in the

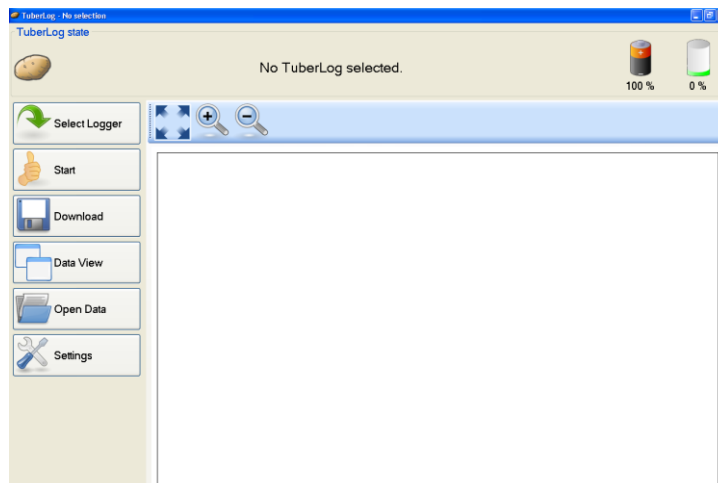


same growing season it is not likely that these settings will need to be changed very often. The settings can only be changed once the data logger has been selected (see 3.1).

### 3. Taking measurements with *TuberLog*

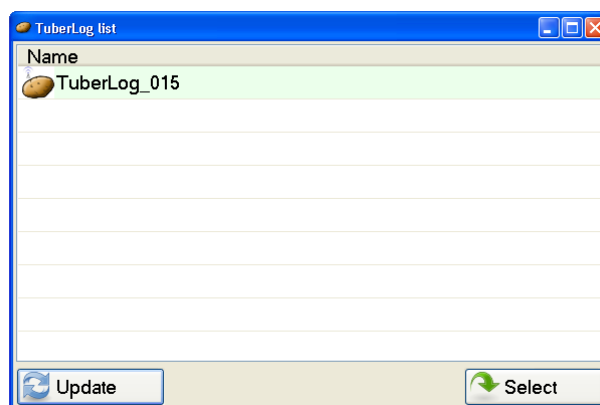
#### 3.1 First steps

When the *TuberLog* software is started the following screen will appear:



Ensure that the data logger is connected to the computer by the USB cable or is able to communicate over the Bluetooth interface. If you are using the Bluetooth interface, gently knock the data logger on a hard surface or shake it in your hand. This process activates the data logger by stimulating its vibration sensor.

Click the **Select Logger** button to display a list of all connected data loggers (USB and Bluetooth). Their connection type is indicated by a standard USB or Bluetooth symbol on the top left of the potato icon, as shown in the ***TuberLog list*** window below:



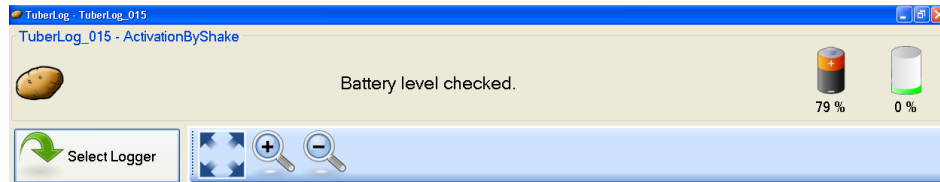
The rows are coloured using 3 different colours, depending on the communication status. These have the following meanings:

- |                  |   |
|------------------|---|
| <b>Tuber-001</b> | The communication status between data logger and computer is unknown. |
| <b>Tuber-001</b> | The last communication with the data logger was successful.           |
| <b>Tuber-001</b> | The last communication attempt was not successful.                    |



Select a data logger from the list by double clicking on the name in the list or by highlighting the name with a single click and then clicking **Select** in the bottom right corner of the *TuberLog list* window.

After selecting a data logger from the list a window with the *TuberLog* number shown at the top is displayed. The software then runs through a sequence of checks in which the battery charge and data logger memory levels are checked and then displayed at the top of the screen, as shown below:



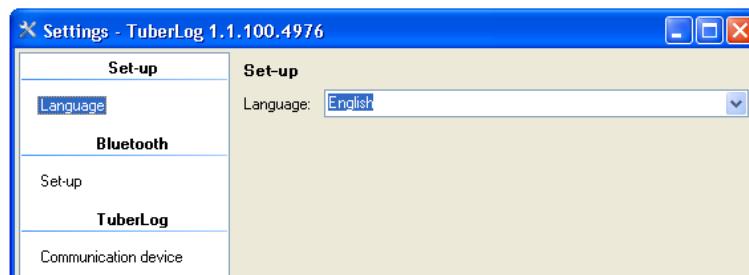
### 3.2 Data logger settings

The data logger has a number of settings that can be viewed after it has been selected. Click on **Settings** to enter the settings menu. Once they have been set up there should be no need to change them for repeated measurements in the same situation. Several settings have already been created using typical values. If required, the selected settings can be saved to a folder in the computer and recalled later using **Import** and **Export** at the bottom of the *Settings* window.

The setting options and explanations for each page are mostly self-explanatory. Tooltips are shown when the cursor hovers over each category. The different setting pages are as follows:

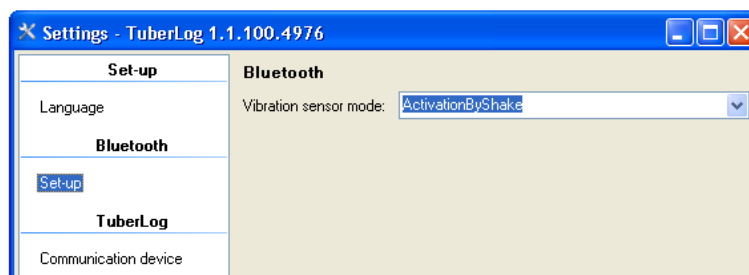
#### Set-up

Enables the display language to be selected



#### Bluetooth

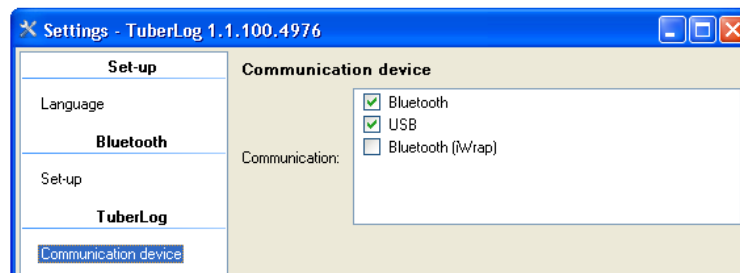
Enables the Bluetooth settings to be changed. Setting the data logger to start by shaking will use battery power in the most efficient way. Alternatively, the interface can be permanently turned off or on.





## TuberLog

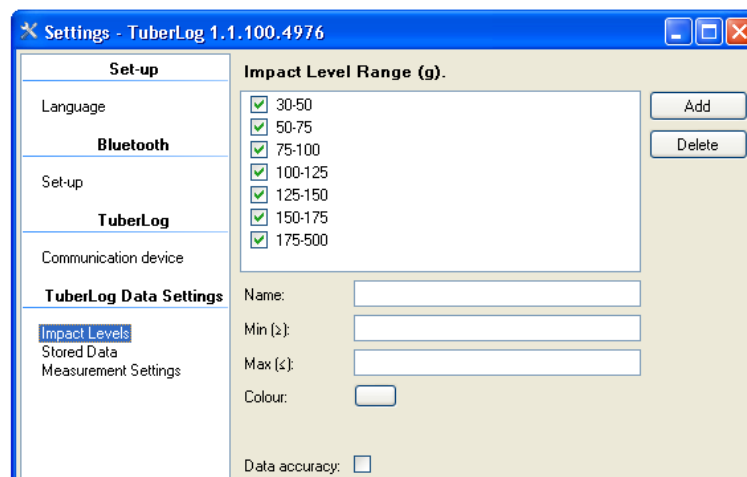
Enables the communication devices that are available to transmit data from *TuberLog* to the computer. If both Bluetooth and USB are available they should both be selected.



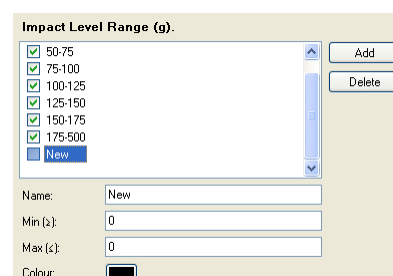
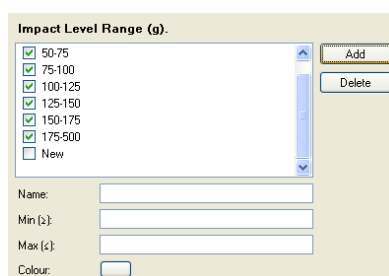
## TuberLog Data Settings

### Impact Levels

- Allows pre-set impact level ranges to be selected for measurements. To improve the accuracy of the calculation of the number and percentage of impacts in the selected ranges, impacts outside these ranges can be excluded by removing the tick from the relevant boxes and ticking the **Data accuracy** box.



- A user-defined *Impact Level Range* can also be created and named by following the stages as below:
  - Click on **Add**. A line with an un-ticked box and **New** will appear. Left click on **New** to highlight it. Default settings will appear in the fields below.





- Enter the values required and a colour that differs from the display colours used for the other *Impact Level Ranges*. To save these settings, left click on **Apply**. To select the new range tick its box, clear the ticks from the ranges that are not needed and left click **Apply** again.

- To delete an *Impact Level Range*, left click to highlight the name, left click **Delete** and left click **Apply**.

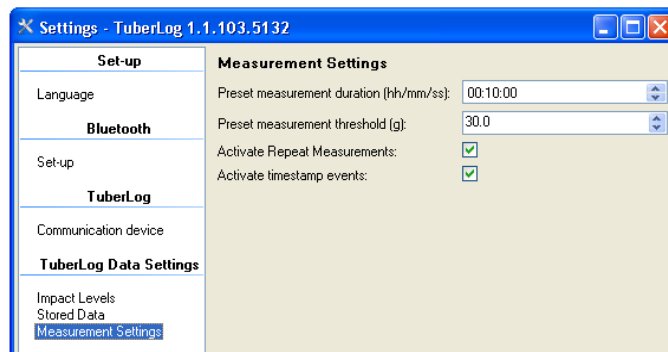
### Stored Data

- Allows the user to define the parameters of the data stored in the data logger and the file location when downloaded for storage in the computer.

### Measurement Settings

- The **Measurement duration** is pre-set at 10 minutes, which would normally be sufficient for testing a typical machine section, but can be changed to suit the situation.
- Setting a lower **Measurement threshold** prevents a lot of small insignificant impacts from being included in the recorded data.
- The option to set **Timestamps** and **Repeat Measurements** in the same section of a machine can be activated. See section 3.4 for more details.
- To ensure an accurate *Timestamp*, check the time setting of the computer and correct it if necessary.

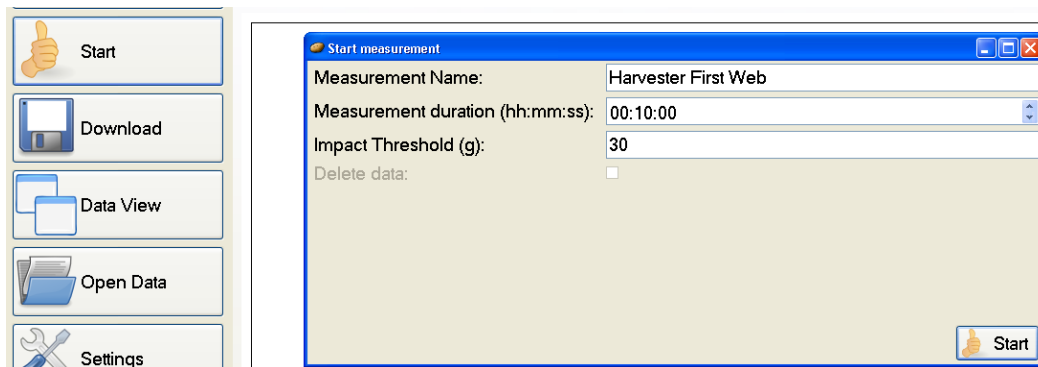




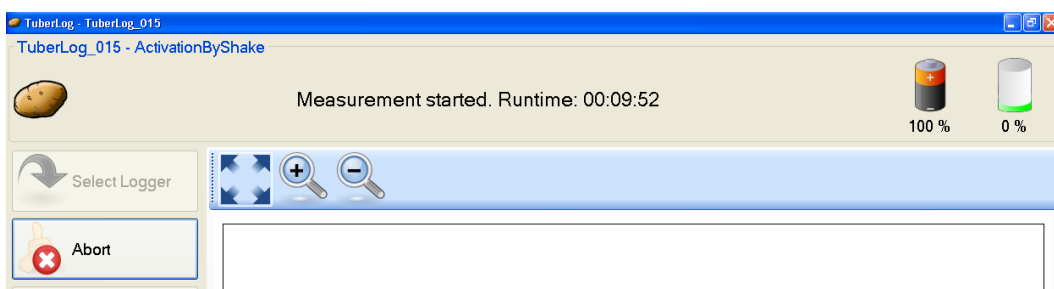
### 3.3 Starting the data logger

When clicking on the **Start** button a window appears, as below, where the **Measurement duration** and lower **Impact Threshold** (minimum of 10g) can be entered (this can also be changed in **Settings**). A **Measurement Name** can also be entered at this stage. This can be useful when testing different machines or sections of a machine.

After making any changes click **Start** in the bottom right corner of the window.



The remaining runtime of the measurement is displayed at the top of the window, as below, which indicates that the measurement has started successfully.

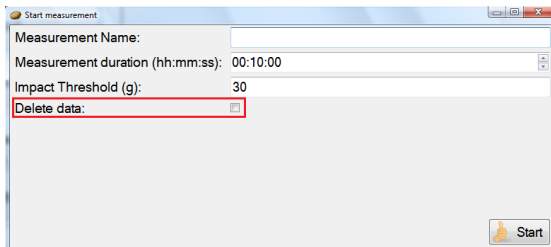


The data logger can now be placed into the machine being tested. **The use of the sealing-cap is strongly recommended.** This allows the unit to be used to measure impacts in potato washers and other wet conditions. *However, do not use the TuberLog in conditions where high heat levels may exist, such as steam peelers.*

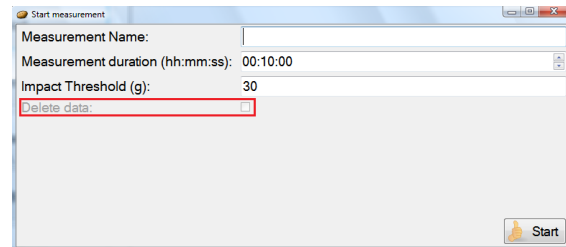


### 3.4 Data logger memory and data deletion

If the **Start** button in the main window is clicked at the same time as the **CTRL**-key the *Start Measurement* window will enable the option to clear the data logger memory before starting a new measurement. This is done by ticking the **Delete data** option before clicking **Start** in the bottom right corner of the window. You will always be asked to confirm if you want to delete the data before the measurement run begins. If **CTRL+ Start** is not clicked in the main window the *Delete data* option is not enabled and remains grayed out.



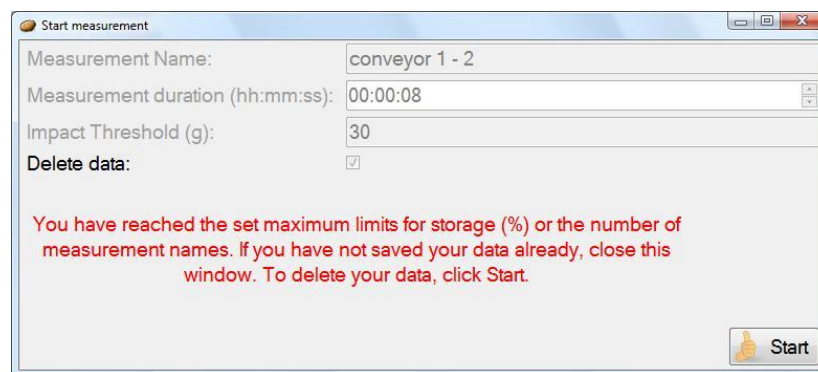
Clicking CTRL+Start enables the option to Delete Data



CTRL+Start was not clicked so there is no option to Delete Data

If the data logger memory is full the newest measurement values will automatically overwrite the oldest entries. Impacts below the set threshold will not enter the memory, so the time before the memory is filled can be extended by setting a higher threshold. Measurements that must be kept for quality assurance purposes should always be downloaded to a computer before the memory is full. The memory level is indicated at the top of the screen every time the data logger is selected before starting a measurement.

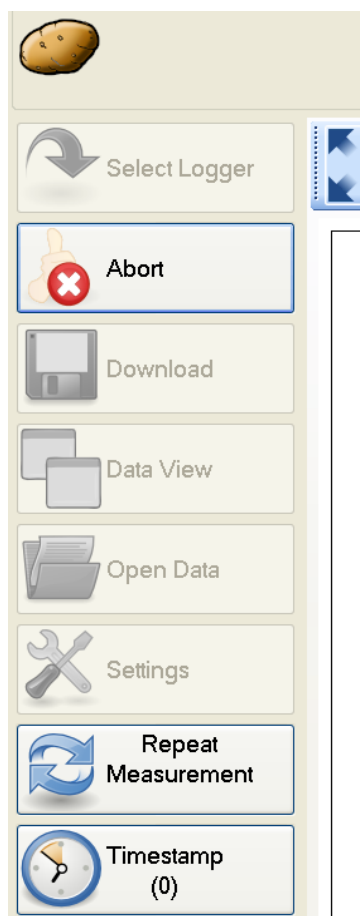
If *Automatic Data Deletion* is ticked in *Stored Data Settings* the software will monitor the data logger's memory in relation to the two set limits (*Max. storage limit (%)* and *Max. measurement names*) and warn you about the possibility of data deletion.



If one of the limits has been reached, **Delete Data** will automatically be ticked in the *Start Measurement* window. You will not be able to untick this option unless space is created in the memory. If you have not been saving your measurements to the computer so far simply close the window and download them. To continue without saving any data, click **Start**.



### 3.5 Adding a timestamp to a measurement and repeating a measurement



After clicking on *Start*, two additional buttons will appear on the bottom of the menu bar. These can be ignored or used as follows:

#### **Timestamp**

Clicking this button during a measurement registers in the data record the time at which it was pressed. This allows, for example, the moment just before the data logger drops from one conveyor to another, to be noted in the record. The timestamps are visible in the graphical display of the measurement results, so it is easy to see if there was a significant impact when the data logger dropped.

#### **Repeat Measurement**

Clicking this button marks a new beginning of a run through a machine without having to start the logger again. This can be useful when investigating a specific part of a machine. Repeating just the drop from, for example, one conveyor to another can be used to check if a large impact occurs on every drop or if it is only occasionally large. Each repeated run is distinguished by colour in the graphical display of measured values.

### 3.6 Typical measurement procedure and interpretation of results

An initial run through a machine will give an impression of where the problem areas are. Each area can be dealt with in more detail by doing shorter measurement runs. The length of run will often be determined by safe access to the machine, but it is best to concentrate on individual sections, such as the drop from one web to another, and carry out repeat measurements in each section.

Repeat measurements give an average figure for an impact at a particular point. This can be compared to bruise test results from real potatoes passing through the same section of the machine. This relationship indicates how *TuberLog* impact levels correspond to bruising levels in real potatoes. Making this comparison in a number of different situations will provide the experience necessary to interpret the results from machines very quickly. It will become possible to know, for example, whether a particular variety can safely be passed through a machine with a known low level of sources of bruising. Experience may have shown that such a variety only starts bruising at a level corresponding to 150g in *TuberLog*, whereas *TuberLog* may only have recorded impacts up to 50g.

The initial measurement run can immediately highlight major sources of bruising. Very high readings obviously indicate high levels of bruising in all varieties and in all conditions. In such situations no comparison with bruise test results is really necessary - the source of bruising must be removed before more potatoes pass through the machine. *TuberLog* can then be passed through the machine again to check that the major problem has been eliminated and to continue the search for more problem areas.



As a guide to the levels of impact that can be generated from a specific drop onto a specific surface, some tests have been carried out using *TuberLog*, with the following results:

| <i>Fall from a height of</i> | <i>onto PVC surface</i> | <i>onto steel surface</i> |
|------------------------------|-------------------------|---------------------------|
| 10cm                         | ~ 55g                   | ~ 175g                    |
| 25cm                         | ~ 155g                  | ~ 275g                    |
| 50cm                         | ~ 285g                  | ~ 330g                    |

### **3.7 Examples of uses for *TuberLog***

The primary use for *TuberLog* is reducing damage and bruising in potato handling machinery. As such, potato growers, producers and processors can clearly benefit from using the device. Other related uses for different groups involved in potato production might include the following:

*Agronomists and Crop Consultants could use TuberLog to:*

- Advise on ideal machine settings for bruise-free production
- Investigate the reasons for product damage by impact forces in machinery
- Carry out objective comparisons of production facilities
- Provide documentary evidence for adherence to quality control procedures

*Manufacturers of harvesting and post-harvesting machinery could:*

- Document the impact levels for use in the sale of their new and used machines
- Demonstrate the quality levels of potatoes passing through their machines
- Improve their machine design by identifying high impact levels
- Assist users to set-up their machines to avoid high impact levels

*Research and development technicians could use TuberLog to:*

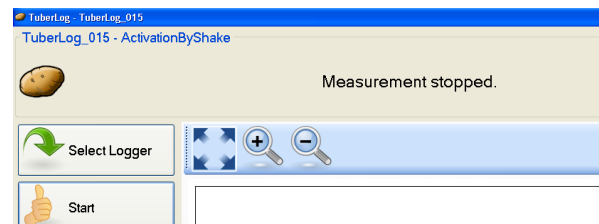
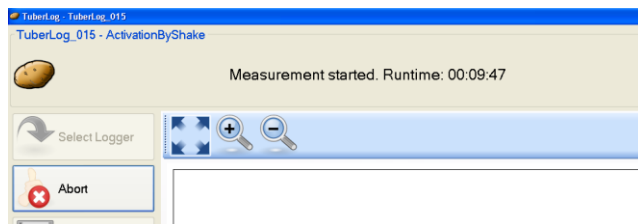
- Investigate technical handling approaches that minimise impact levels on potatoes
- Determine thresholds for the risk of damage to potatoes due to impact force
- Investigate different materials that would reduce the risk of damage to potatoes



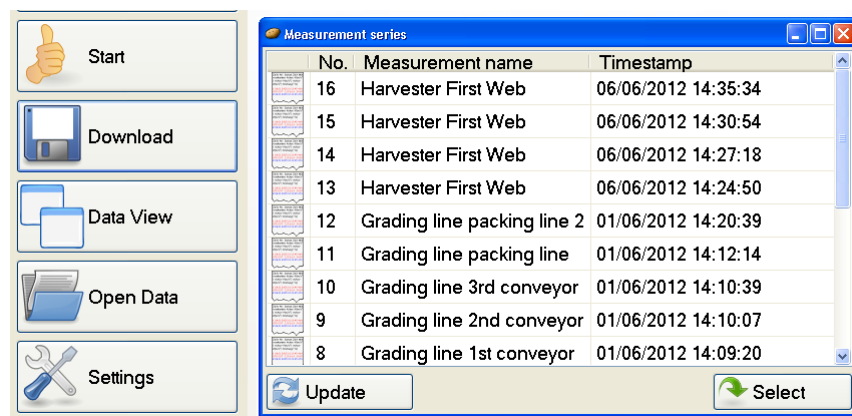
## 4. Displaying *TuberLog* data

### 4.1 Selecting data for display

To display measurements from the data logger while a measurement run is still in progress, click on the **Abort** button which is visible during a measurement.



Click the **Download** button to open a new window showing the list of measurement runs and their recording date that are stored in the data logger. Click on the measurement you wish to view and then click **Select** in the bottom right corner of the window.

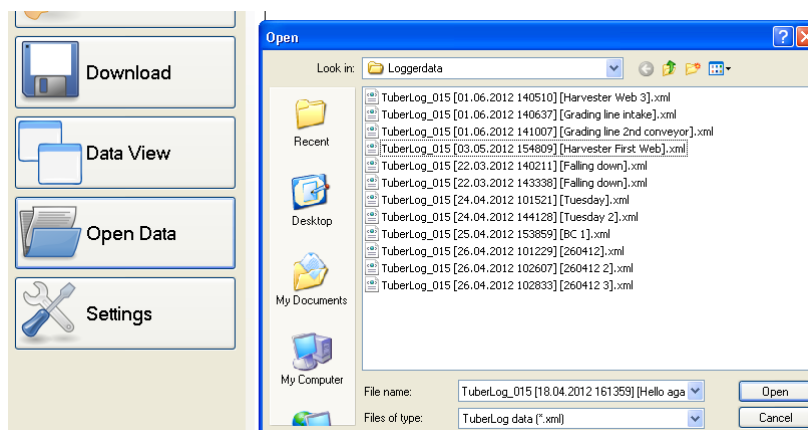


The data will be displayed more quickly via the USB interface than the wireless Bluetooth interface.

If the option to *Save TuberLog Data* has been ticked under *Settings/Stored Data*, the measurement run will be saved as a file in the Loggerdata folder that was set up during the software installation. The filename is formatted as:

*TuberLog serial number [Date and time of measurement][Measurement name].xml*

Click **Open Data** to display the measurement runs which have already been saved to the Loggerdata folder (see below). Highlight the file to be viewed and click **Open**.

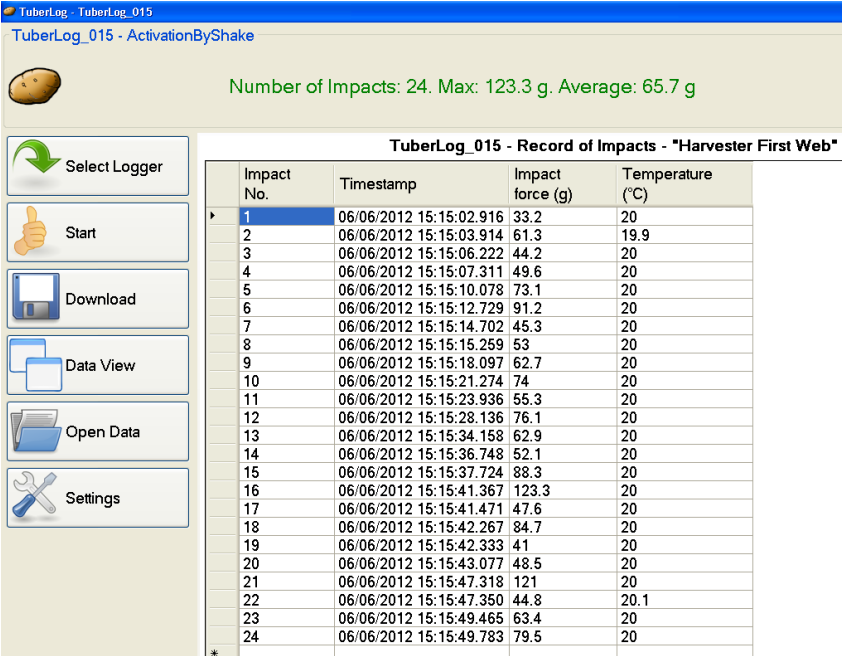




## 4.2 Viewing the data

To change the data display of the measurement run that has been selected, click on **Data View**. There is a choice of 3 ways to view the data. Click **Data View** again to change between them.

### 4.2.1 Data table of the impacts during a measurement



TuberLog\_015 - ActivationByShake

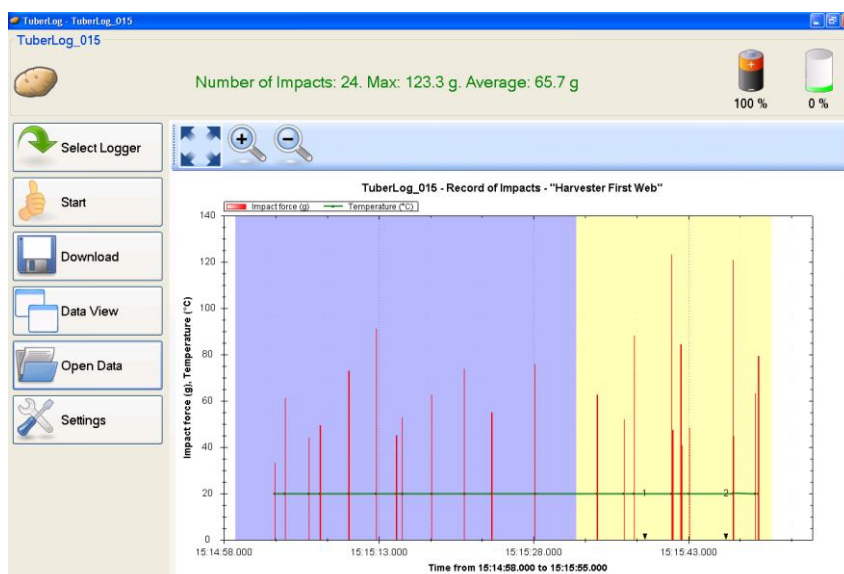
Number of Impacts: 24. Max: 123.3 g. Average: 65.7 g

TuberLog\_015 - Record of Impacts - "Harvester First Web"

| Impact No. | Timestamp               | Impact force (g) | Temperature (°C) |
|------------|-------------------------|------------------|------------------|
| 1          | 06/06/2012 15:15:02.916 | 33.2             | 20               |
| 2          | 06/06/2012 15:15:03.914 | 61.3             | 19.9             |
| 3          | 06/06/2012 15:15:06.222 | 44.2             | 20               |
| 4          | 06/06/2012 15:15:07.311 | 49.6             | 20               |
| 5          | 06/06/2012 15:15:10.078 | 73.1             | 20               |
| 6          | 06/06/2012 15:15:12.729 | 91.2             | 20               |
| 7          | 06/06/2012 15:15:14.702 | 45.3             | 20               |
| 8          | 06/06/2012 15:15:15.259 | 53               | 20               |
| 9          | 06/06/2012 15:15:18.097 | 62.7             | 20               |
| 10         | 06/06/2012 15:15:21.274 | 74               | 20               |
| 11         | 06/06/2012 15:15:23.936 | 55.3             | 20               |
| 12         | 06/06/2012 15:15:28.136 | 76.1             | 20               |
| 13         | 06/06/2012 15:15:34.158 | 62.9             | 20               |
| 14         | 06/06/2012 15:15:36.748 | 52.1             | 20               |
| 15         | 06/06/2012 15:15:37.724 | 88.3             | 20               |
| 16         | 06/06/2012 15:15:41.367 | 123.3            | 20               |
| 17         | 06/06/2012 15:15:41.471 | 47.6             | 20               |
| 18         | 06/06/2012 15:15:42.267 | 84.7             | 20               |
| 19         | 06/06/2012 15:15:42.333 | 41               | 20               |
| 20         | 06/06/2012 15:15:43.077 | 48.5             | 20               |
| 21         | 06/06/2012 15:15:47.318 | 121              | 20               |
| 22         | 06/06/2012 15:15:47.350 | 44.8             | 20.1             |
| 23         | 06/06/2012 15:15:49.465 | 63.4             | 20               |
| 24         | 06/06/2012 15:15:49.783 | 79.5             | 20               |

Individual impact records from a measurement run can be selected in the table and saved as a CSV file for further analysis and processing in a program such as Microsoft Excel. To select a record left click in the grey column to the left of the row. The whole row will be highlighted. Right click in the highlighted area to display a *Save Selection* window. Clicking on this window will take you to the Loggerdata folder where you can save the record with a name of your choice. To select a sequence of records or several non-sequential records use Ctrl+left click in the grey column and continue as above.

### 4.2.2 Data graph of the impacts during a measurement



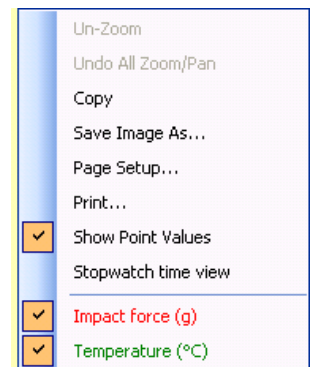


In the example a series of repeat measurement runs (blue and yellow) with two time stamps (1, 2) is shown. The horizontal green line is the temperature recorded by the data logger.

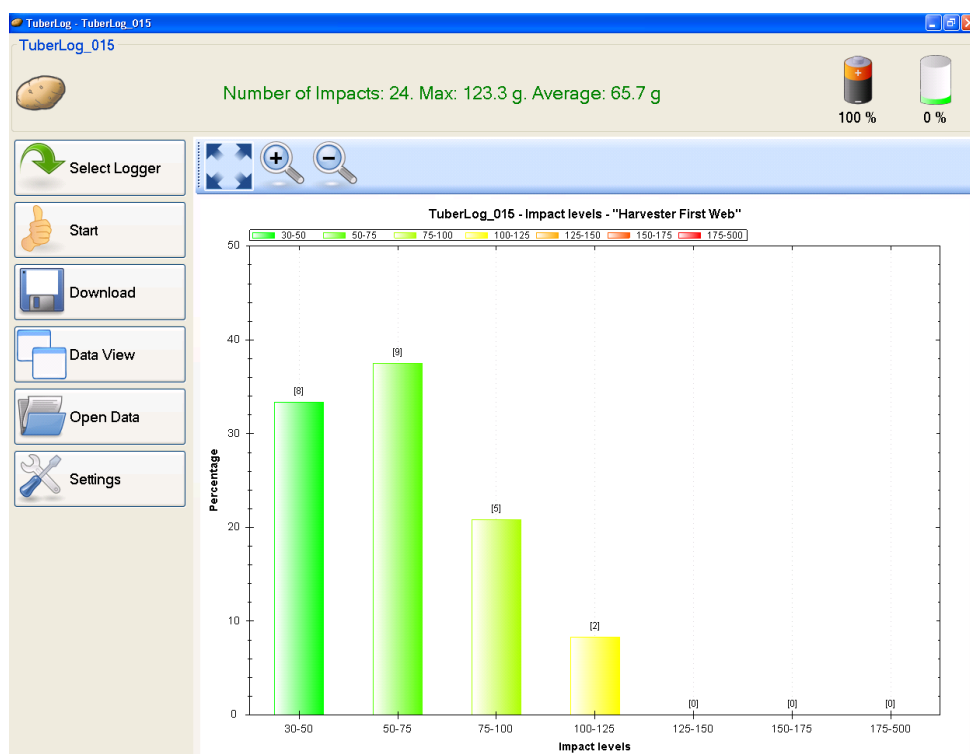
There are buttons above the graph for zooming in and out and for resetting to the original state. It is also possible to reduce the time period displayed by drawing a rectangle onto the graph while holding down the left mouse key.

Right click on the graph to open a menu with further adjustable settings for visual display and printout.

The result can be saved to the clipboard (*Copy*) or as an image file. This can be useful for report generation.



#### 4.2.3 Data graph of the percentage distribution of the impacts from a measurement



In addition to the percentage distribution, this graph also shows the number recorded in each group of impact levels. If the *Data accuracy* option is ticked in *TuberLog Data Settings/Impact levels*, only the records which fit into the preset groups of impact levels will be included in the percentage calculation. This graph type can be manipulated, printed and saved in the same ways as in 4.2.2 above.



## **5. Maintenance and care of *TuberLog***

### **5.1 The Data Logger**

Little ongoing maintenance of the data logger is required. It is a sealed waterproof unit and must not be opened by the user. Any warranty will be invalidated if the data logger has been opened.

During use, it is advisable to keep the surface of the data logger clear of accumulated mud. If allowed to harden on the surface any mud could affect the response of the unit to impacts.

### **5.2 General Care**

*TuberLog* is a sophisticated and delicate electronic instrument that should be treated with care. It should be treated as if it was a real potato being produced to the highest possible quality. Like a real potato, *TuberLog* will be permanently damaged if it is dropped onto hard surfaces such as concrete. If a badly adjusted potato harvester is seriously damaging potatoes, for example by squeezing them through the haulm rollers, it must be assumed that *TuberLog* will also be damaged in this way. The examples given are non-exhaustive. The manufacturers cannot be held responsible for this kind of traumatic damage and it is the responsibility of the user to make sure that *TuberLog* is not put into a situation where such damage could occur.

## **6. Warranty**

*TuberLog* is guaranteed for 12 months from the date of purchase against any defect or malfunction caused by faulty parts or workmanship. To claim under warranty, the complete set should be returned in its carry case, at the claimant's expense, to the supplier with a written explanation of the problem. Should there prove to be a defect or malfunction caused by faulty parts or workmanship, it will be repaired or replaced and returned to the claimant without charge. If a warranty claim is rejected, the cost of replacement or repair will be notified to the claimant before any work is carried out.

Any warranty claim will automatically be invalidated if the data logger has been opened or internally tampered with in any way. Damage or faults occurring which are deemed by the manufacturers or distributors to have been caused by inappropriate use of the equipment or by use not in accordance with the instruction manual will not be covered under warranty. Under no circumstances will the supplier re-imburse any costs associated with a warranty claim if these costs have been incurred without agreement in advance.

Under the terms of warranty under no circumstances will liability exceed the cost of replacement or repair. The manufacturer ESYS GmbH and the distributor Martin Lishman Ltd will not be liable for any consequential or indirect loss suffered by purchasers or users of *TuberLog*, whether this loss arises from correct or incorrect use of the data logger and software, defect or malfunction caused by faulty parts or workmanship or in any other way. Non-exhaustive illustrations of consequential or indirect loss are loss of profits, loss of contracts and damage to property.

Full Terms and Conditions of Sale can be supplied on request or viewed on our website [www.martinlishman.com](http://www.martinlishman.com).



## 7. Appendix

### **TuberLog** Technical data

TuberLog captures all impacts during a selectable measurement period while using a sampling rate of 3000 Hz. When exceeding a preset threshold, the peak values of the 3 acceleration axes (x,y,z) are saved continuously in a millisecond cycle until the impact falls below the threshold again.

- Measured variable sensor: Acceleration / Temperature semiconductor sensor
- Measurement range acceleration: up to 250g, Resolution 0,1g, Accuracy  $\pm 1$
- Measurement range temperature: -40 to +125°C, Resolution 0,1°C, Accuracy  $\pm 1^\circ\text{C}$
- Measurement duration: up to approx. 16 hours
- Memory capacity: 425,984 measurement value pairs
- Data preservation: >10 years without battery
- Power supply: Lithium-ion-battery 3,6V, 850mAh rechargeable in approx. 2 hours
- Operating temperature range: - 10°C to +70°C
- PC Interfaces: USB, Bluetooth
- Dimensions: approx. 90 x 65 x 50 mm
- Weight : 200g
- Compatible software OS: MS-Windows XP/7
- Format of saved data: \*.xml
- Format of exported data: ASCII-compliant CSV-Format

#### **For technical help:**

Please send a description of your query to:

TuberLog manufacturers:

*Esys GmbH* E-mail: info@esys.de; Fax: +49 (0) 30/443294-10

TuberLog distributors:

*Martin Lishman Ltd* E-mail: sales@martinlishman.com; Tel: +44 1778 426600

#### ***Proper disposal of the data logger***

Please support us with the proper disposal of the data logger, protecting our environment and also take care of local rules and regulations:

The proper disposal of electronic broken or disused devices is a legal duty of both the manufacturer and buyer alike. Electronic waste may not be disposed as domestic rubbish.

From *ESYS GmbH* manufactured and disused devices may not be returned into public recycling systems. They have to be returned directly to *ESYS GmbH*. *ESYS GmbH* accepts returned disused devices (made by *ESYS GmbH*) free of charge for proper disposal/recycling.

